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Sandrone, Stefano

DOI: https://doi.org/10.1007/s00415-013-7036-6

Originally published at:
Sandrone, Stefano (2014). Giuseppe Moruzzi (1910–1986). Journal of Neurology, 261(7):1447-1448.
DOI: https://doi.org/10.1007/s00415-013-7036-6

J Neurol (2014) 261:1447–1448
DOI 10.1007/s00415-013-7036-6

PIONEERS IN NEUROLOGY

Giuseppe Moruzzi (1910–1986)

Stefano Sandrone

Received: 6 April 2013 / Revised: 1 July 2013 / Accepted: 4 July 2013 / Published online: 23 July 2013

Giuseppe Moruzzi was born in Campagnola Emilia, a small town near Reggio Emilia, Italy, son of Giovanni Moruzzi and Bianca Carbonieri. He grew up in Parma, where his father was a general medical practitioner [2]. A lover of history and literature, he was not thinking of medical studies during his high-school years. Eventually, considering the difficult economic situation of Italy in the late 1920s, he chose medicine because it would be easier to find a job in medicine than in the humanities. By this choice he also carried on his family tradition, which started with his great-grandfather, professor of general pathology in Parma during the 1840s [8], and continued with his uncle, collaborator of Jean-Martin Charcot.

In 1927 Moruzzi graduated *magna cum laude* from the University of Parma, which provided him with a stimulating environment and excellent teachers. Prominent among them was the neuroanatomist Antonio Pensa, pupil of Camillo Golgi. Moruzzi sometimes started to work at five o'clock in the morning, and, because of his dedication to work, he was given the key of the small lab with its very old instruments [8]. In 1930, as a third year student, he published his first paper, on the granular layer of the cerebellum [8].

When Pensa moved to Pavia, Moruzzi remained in Parma because he could not afford to stay away from home and because he preferred neurophysiology to anatomy. He became an assistant at the Institute of Physiology with Mario Camis, who familiarized him with the skills and the ideas he had learnt during his stay in Liverpool with the future Nobel laureate Charles Scott Sherrington. Moruzzi focused on transneural degeneration, the action of curare, vasomotor action and respiratory reflexes. In 1936 he moved to Bologna, following his new mentor [2, 8]. Not much later he spent a very productive year in Brussels with Frédéric Bremer, a leading neurophysiologist, well-known for his studies on the physiology of sleep.

In Belgium, Moruzzi refined his way of thinking and of his scientific imagination [10]; he published eight reports, each time as single author. In 1939, Moruzzi joined the Nobel laureate Lord Edgar Douglas Adrian in Cambridge on a Rockefeller Foundation fellowship. Since he had the privilege to work directly with Adrian, and this close collaboration further strengthened his logic, intuition and

S. Sandrone
NATBRAINLAB—Neuroanatomy and Tractography Brain Laboratory, Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, King's College, London SE5 8AF, UK

S. Sandrone (✉)
Institute of Neuroinformatics, University of Zurich and ETH Zurich, Winterthurerstrasse 190, 8057 Zurich, Switzerland
e-mail: sandronestefano@ini.ethz.ch

physiological skills [8]. Moruzzi's main achievement in Cambridge was the recording of the activity of isolated single neurons of the pyramidal tract in the cat [1, 7]. In 1939 he won a Lewis Fellowship, but could not spend it in Cambridge because the Second World War forced him to come back to Bologna and to serve in the Medical Corps of the Italian Army. Subsequently he was appointed Professor of Physiology at the University of Siena (1942–1943), Parma (1945–1946), Ferrara (1946–1948) and Pisa (1948) [10]. He was then invited to Chicago on a Rockefeller Foundation Visiting Professorship, but at Northwestern University the Institute he was supposed to join was dismantled after the death of Stephen W. Ranson (1880–1942). In 1948, Horace W. Magoun helped him find laboratory facilities in the Anatomy Department and their collaboration produced the first evidence for a 'reticular ascending system' responsible for arousal [4, 7, 9]. They found this system desynchronized the electrical activity of the brain, whereas a second, descending reticular system blocked motor activity in the spinal cord [2]. In 1949 he returned to Italy as Head of the Institute of Human Physiology in Pisa. The Institute was almost empty, because most instruments had been destroyed or lost during the war. Fortunately, Moruzzi received a generous grant from the Rockefeller Foundation enabling him to acquire the necessary equipment for physiological studies and with Italian funds he bought a remarkable library [3]. He held his leading position until his retirement in 1980. From 1968 to 1980 Moruzzi also directed the Laboratory of Neurophysiology of the Consiglio Nazionale delle Ricerche. His research in Pisa involved conditioned reflexes and the neural mechanisms underlying the sleep-waking cycle [3, 5]. His Institute became one of the major European neuroscience centres, especially for sleep studies. Moruzzi attracted brilliant young students: some of them became renowned clinicians, for example Alberto Zanchetti and Gian Franco Rossi, while most followed his steps in physiology. The 'Moruzzi school' of physiology includes, among others, Arnaldo Arduini, Giovanni Berlucchi, Emilio Bizzi, Lamberto Maffei, Giacomo Rizzolatti and Piergiorgio Strata. Moruzzi was granted honorary degrees by the Universities of Pennsylvania (1963), Lyon (1963), Louvain (1964), Oslo (1965), Zurich (1969) and Munich (1972). He received several other awards, including the Feltrinelli Prize of the Accademia dei Lincei (1956), the Karl Lashley Award (1963), the International Saint Vincent Prize (1969) and the Kenneth Craik Award (1971). A strong supporter of the history of neuroscience and of the need to bridge humanities with biomedical research, he was respected and admired by the entire neuroscientific community. As a member of the Accademia dei Lincei, he was regarded as one of the greatest Italian scientists of the 20th century [2], 'an enlightened leader who foreshadowed and promoted neuroscience as we know it today' [7], and, according to the Nobel laureate Rita Levi-Montalcini, a perfect model for the young generation as well as a 'formidable scientist and a formidable man' [6].

In 1975 the symptoms of Parkinson's disease began to appear; nevertheless, he carried on enjoying scientific research. During his last months, Moruzzi, aware of the rapid aggravation of his illness, started sending some personal books to his home in Noceto, a village near Parma: his large desk gradually became bare instead of the usual papers and letters [10]. He died on 11 March 1986, at the age of 76, leaving behind his wife Maria Vittoria Venturini and his sons Giovanni and Paolo. His name is now attached to the Moruzzi Lecture that, from 1980 on, is annually delivered at the European Neuroscience Society.

Acknowledgments Many thanks to Giovanni Berlucchi and Giacomo Rizzolatti for the kind and precise remarks on this text and for providing the picture. Last but not least, many thanks to Jan van Gijn for his thoughtful and outstanding comments on every 'Pioneer of Neurology' manuscript.

Conflicts of interest The corresponding author states that there is no conflict of interest.

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